



ANL/EES-TM-289

EFFECTS ON MINORITY AND LOW-INCOME HOUSEHOLDS
OF THE EPA PROPOSAL TO REDUCE
LEADED GASOLINE USE

RETURN TO REFERENCE FILE
TECHNICAL PUBLICATIONS
DEPARTMENT




ARGONNE NATIONAL LABORATORY
Energy and Environmental Systems Division

Operated by

THE UNIVERSITY OF CHICAGO for U. S. DEPARTMENT OF ENERGY

under Contract W-31-109-Eng-38



Argonne National Laboratory, with facilities in the states of Illinois and Idaho, is owned by the United States government, and operated by The University of Chicago under the provisions of a contract with the Department of Energy.

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

This informal report presents preliminary results of ongoing work or work that is more limited in scope and depth than that described in formal reports issued by the Energy and Environmental Systems Division.

Printed in the United States of America. Available from National Technical Information Service,
U. S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161.

ARGONNE NATIONAL LABORATORY
9700 South Cass Avenue, Argonne, Illinois 60439

ANL/EES-TM-289

EFFECTS ON MINORITY AND LOW-INCOME HOUSEHOLDS
OF THE EPA PROPOSAL TO REDUCE
LEADED GASOLINE USE

by

K. Rose, S. LaBelle, R. Winter, and Y. Klein

Energy and Environmental Systems Division

April 1985

work sponsored by

U.S. DEPARTMENT OF ENERGY
Office of Minority Economic Impact
Research and Education Division

CONTENTS

| | |
|---|-----|
| FOREWORD | vi |
| ACKNOWLEDGMENTS | vii |
| ABSTRACT | 1 |
| SUMMARY | 1 |
| 1 INTRODUCTION | 5 |
| 2 BACKGROUND | 7 |
| 2.1 Chronology of Leaded Gasoline Regulation | 7 |
| 2.2 EPA Views on Health Benefits Due to Reduced Lead in Gasoline | 8 |
| 2.3 Other Views on Health Benefits | 9 |
| 2.4 Summary | 10 |
| 3 BENEFITS TO MINORITY AND LOW-INCOME HOUSEHOLDS FROM REDUCED LEAD IN GASOLINE | 11 |
| 3.1 Households by Race and Income | 11 |
| 3.2 Central City Households with Small Children | 12 |
| 3.3 Small Children in Central Cities | 14 |
| 3.4 Summary | 14 |
| 4 COSTS DUE TO OWNERSHIP OF LEADED GASOLINE VEHICLES | 18 |
| 4.1 Costs to Households | 18 |
| 4.2 Incidence of Costs | 20 |
| 4.3 Vehicle Population | 24 |
| 4.4 Summary | 27 |
| 5 HOUSEHOLD BENEFITS AND COSTS | 28 |
| APPENDIX A: Sample Size for RECS2 | 33 |
| APPENDIX B: Poverty-Level Households | 35 |
| APPENDIX C: Classification of Household Vehicles as Leaded Fuel Users | 36 |
| REFERENCES | 39 |

FIGURES

| | |
|---|----|
| 1 U.S. Census Regions for the 48 Contiguous States | 5 |
| 2 National Households by Location, 1981 | 13 |
| 3 SMSA Central City Households by Race and Income, 1981 | 13 |

FIGURES (Cont'd)

| | | |
|---|--|----|
| 4 | Percentages of SMSA Central City Households with Small Children, by Race and Household Income, 1981 | 16 |
| 5 | SMSA Central City Households with Small Children, by Race, 1981, as a Percentage of the Respective Populations | 16 |
| 6 | SMSA Central City Households with Small Children, by Household Income, 1981, as a Percentage of the Respective Populations | 17 |
| 7 | Households Owning Only Leaded Gasoline Vehicles, 1981, by Race and Income, 1981 | 21 |
| 8 | Percentages of Households Owning Only Leaded Gasoline Vehicles, by Race, 1981 | 23 |
| 9 | Percentages of Households Owning Only Leaded Gasoline Vehicles, by Income, 1981 | 24 |

TABLES

| | | |
|-----|---|----|
| S.1 | Share of Benefits and Costs Due to Reduced Lead in Gasoline, by Percentage of Households in U.S. | 3 |
| 1 | Households by Race, Income, and Location, 1981 | 11 |
| 2 | SMSA Central City Households by Race and Income, 1981 | 12 |
| 3 | SMSA Central City Households with Children under Seven Years of Age, 1981 | 14 |
| 4 | Distribution of SMSA Central City Households by Age of Children, 1981 | 15 |
| 5 | Small Children in SMSA Central Cities, 1981 | 17 |
| 6 | Households with Leaded Gasoline Vehicles, 1981 | 19 |
| 7 | Distribution of Household Vehicles by Gasoline Type, 1981 | 22 |
| 8 | Gasoline Purchases as a Percentage of Household Income in the 48 Contiguous States, April 1980-March 1981 | 25 |
| 9 | Leaded Vehicle Ownership, 1981 | 25 |
| 10 | Households Owning Leaded Gasoline Vehicles in the 48 Contiguous States in 1981, and Projected Ownership for 1986 and 1988 | 26 |
| 11 | Households Owning Only Leaded Gasoline Vehicles in the 48 Contiguous States in 1981, and Projected for 1986 and 1988 | 26 |

TABLES (Cont'd)

| | | |
|-----|--|----|
| 12 | National Households, by Minority and Income Category, to Which Benefits and Costs Accrue Because of Reduced Lead in Gasoline, 1981 | 29 |
| 13 | U.S. Households in the Low, Medium, and High Categories of Benefits and Costs, 1981 | 30 |
| A.1 | Households Sample Counts in RECS2, 1981 | 33 |
| B.1 | Criteria for 125% Poverty Level, 1981 | 35 |
| C.1 | Household Vehicles Using Leaded Fuel | 37 |
| C.2 | Model Year 1971 and Earlier Household Vehicles | 38 |

FOREWORD

The Office of Minority Economic Impact (MI) in the U.S. Department of Energy (DOE) was created by the U.S. Congress in 1979 because of concern about the effects of energy shortages and rising energy prices on low-income and disadvantaged minority groups. The law requires MI to perform certain activities, including a research program to:

- Determine the average energy consumption and use patterns of minorities relative to those of other population groups.
- Evaluate the percentage of disposable income spent on energy by minorities compared to that of other population groups.
- Determine how programs, policies, and actions of the Department of Energy and its components affect such consumption and use patterns and income.
- Conduct market research, planning, economic and business analysis, and feasibility studies to identify, define, and promote economic opportunities for minorities in energy research, production, conservation, and development.

As part of its effort to comply with this mandate, MI asked Argonne National Laboratory to conduct a multiyear research program on minority* energy consumption and expenditures. This program involves three distinct tasks:

- Assemble a data base and develop the tools to assess the effects of energy policy and programs on minorities.
- Assess the effects of relevant programs on minorities and examine optional ways (e.g., policy, legislative, or regulatory changes) to alleviate the hardships experienced by those groups.
- Assist minority-owned energy-related businesses with energy market research.

The present report is one in a series of reports that have been produced by Argonne in its performance of these tasks. Further information about the overall MI research program can be obtained by contacting either Georgia Johnson, the research program manager for DOE's Office of Minority Economic Impact; James A. Throgmorton, the principal investigator at Argonne; or the authors.

*The legislation defines the term "minority" to include any citizen of the United States who is black, American Indian, Asian, Eskimo, Aleut, or a Spanish-speaking person of Spanish descent.

ACKNOWLEDGMENTS

The authors thank their colleagues in the Center for Transportation Research and the Integrated Assessments and the Policy Evaluation Group at Argonne for their comments and insights on the development of this paper from its earlier versions. Particular thanks also go to James Throgmorton for his guidance and patience, to Charles Malefyt for his editing, and to the word processing center of the Energy and Environmental Systems Division for its help in producing this report.

EFFECTS ON MINORITY AND LOW-INCOME HOUSEHOLDS OF THE EPA PROPOSAL TO REDUCE LEADED GASOLINE USE

by

K. Rose, S. LaBelle, R. Winter, and Y. Klein

ABSTRACT

To reduce the potentially harmful environmental effects of lead in the environment, the U.S. Environmental Protection Agency (EPA) has proposed a reduction in the amount of lead used in leaded gasoline. This report examines the potential impacts of such action on minority and low-income households in the U.S. The benefits of the EPA's proposal would presumably accrue primarily to households that contain small children and that are located in the central cities of metropolitan areas. This is because small children (under age seven) are particularly susceptible to the effects of lead and also because the automobile traffic density in central cities is higher than in any other area. Potential costs are examined in terms of households that own vehicles requiring leaded gasoline. Costs could accrue either because of higher gasoline prices due to reduced lead content or because of higher vehicle repair costs for engines that must use leaded gasoline to prevent excessive wear. Because of their location and number, minority and low-income households with small children would benefit more than the average U.S. household. No costs would be incurred by the relatively large segment of minority and low-income households that own no vehicles. However, the Hispanic and other minority (except black) and low-income households that do own vehicles have a greater than average share of vehicles that require leaded gasoline; costs to these households because of the EPA's proposed action would be comparatively high.

SUMMARY

To reduce the potentially harmful environmental effects of lead used in gasoline, the U.S. Environmental Protection Agency (EPA) has proposed a reduction in the amount of lead in gasoline from 1.1 grams of lead per gallon of leaded gasoline (gplg) to 0.1 gplg, to take effect either at the beginning of 1986 or to be achieved through gradual reduction to the lower level by 1988.* In addition, a ban on the use of leaded gasoline is

*In March 1985 (after completion of this report), EPA promulgated a final rule on a low-level standard of 0.1 gplg effective January 1, 1986, with an interim standard of 0.5 gplg effective July 1, 1985.

being considered for the mid-1990s. This report addresses some of the benefits and costs that could accrue to minority* and low-income households† if the EPA's proposals are adopted. The data sources for this report are the Residential Energy Consumption Surveys taken by the Department of Energy's Energy Information Administration in 1980-1981 and 1981-1982.

BENEFITS

Benefits due to reduced use of lead in gasoline are assumed to accrue primarily to households that contain small children (less than seven years old) and that are located in central cities of Standard Metropolitan Statistical Areas (SMSAs). This is based on the assumption that traffic density is higher in SMSA central cities than elsewhere and that households in these areas are therefore exposed to higher levels of lead from vehicles using leaded gasoline. It is also based on EPA research indicating that small children are more vulnerable than adults to lead exposure.

No attempt is made here to monetize the benefits associated with reducing blood lead levels of children in minority or low-income households (the EPA analysis should be referred to for a monetized estimate of these benefits). Rather, this report estimates the proportional share of SMSA central city households with small children in terms of how minority and low-income households compare to all U.S. households.

COSTS

The distribution of costs varies with the proposals under consideration. For reduction to 0.1 gplg, higher refining costs are likely to result in prices higher than currently charged for leaded gasoline. A ban on leaded gasoline could impose costs on owners of vehicles that require leaded gasoline to lubricate engine valves. In the absence of lead, these vehicles may incur greater engine-repair expenses or may have to be scrapped prematurely; no distinction is made between the two costs. Leaded gasoline vehicles are those in which the use of leaded gasoline will not damage the vehicle's pollution control equipment. As in the case of benefits, the costs are not monetized.

Over time, the cost to minority and low-income households will be reduced because the number of leaded gasoline vehicles they own will decrease considerably. For the six-year period from 1981 through 1986, the number of leaded gasoline vehicles is expected to decrease by 58.3%, based on a method used in this report.

*This report focuses on black and Hispanic minority groups.

†Low-income households have annual incomes of less than 125% of the poverty level.

SHARE OF BENEFITS AND COSTS

Table S.1 lists the share of benefits and costs due to reduced lead in gasoline. The low-benefit category includes non-SMSA households with no children or older children only. High benefits accrue to households with small children in SMSA central cities. Low costs accrue to households that own only vehicles requiring unleaded gasoline or no vehicles at all. High costs accrue to households that own only leaded gasoline vehicles. Discussion of the medium-benefit and -cost categories is provided in Section 5 of this report.

The highest percentages of minority households are in the high-benefit and low-cost categories. There is a considerable difference here between the share of minority households and the share of all households. The largest share is that for black households (11.3%); Hispanic households rank second. This compares with 3.2% for all U.S. households and 1.7% for white households. Low-income households also accounted for a higher share than did the overall population.

Minority and low-income households also have higher than average shares in the high-benefit and high-cost categories. The share of all U.S. households here is 2.0%, while Hispanic households have the highest minority share at 6.9%.

Among households receiving low benefits, minorities are below the U.S. average. On the other hand, low-income households account for the largest shares in both the low- and high-cost categories. This difference is apparently due to the number of white low-income households that have no children or older children only, reside in non-SMSA areas, and have no vehicles or only vehicles that use leaded gasoline. A total of 15.1% of the households with incomes above 125% of the poverty level are in the low-benefit categories.

TABLE S.1 Share of Benefits and Costs Due to Reduced Lead in Gasoline, by Percentage of Households in the U.S.^a

| Cost and Population Category | Benefits | |
|------------------------------|----------|------|
| | Low | High |
| Low Cost | | |
| All U.S. Households | 9.3 | 3.2 |
| White | 9.7 | 1.7 |
| Black | 9.2 | 11.3 |
| Hispanic | 5.2 | 8.9 |
| Other | 4.3 | 11.1 |
| Low Income | 15.0 | 7.9 |
| Other | 8.0 | 2.1 |
| High Cost | | |
| All U.S. Households | 7.8 | 2.0 |
| White | 8.6 | 1.4 |
| Black | 4.8 | 3.6 |
| Hispanic | 4.2 | 6.9 |
| Other | 1.4 | 3.8 |
| Low Income | 10.7 | 3.6 |
| Other | 7.1 | 1.6 |

^aThe 48 contiguous states.

Source: Residential Energy Consumption Survey, 1981-1982; Household Monthly Energy Consumption and Expenditures, U.S. Dept. of Energy (1982).

CONCLUSIONS

Minority and low-income households would receive proportionately higher benefits from EPA's proposed actions than would the overall U.S. population (because a higher proportion of minority and low-income households are in SMSA central cities and have small children). However, while the largest share of minority households would receive proportionately high benefits at low cost, a higher-than-average proportion of minority and low-income households would receive high benefits at high cost (because of their relatively high rate of ownership of only leaded gasoline vehicles).

The largest share of low-income households would receive low benefits at low cost (due to non-SMSA, white low-income households that have no vehicles). Also, a higher-than-average share of low-income households would receive low benefits at high cost (because of their relatively high rate of ownership of leaded gasoline vehicles). This last category appears to be at the greatest potential disadvantage because of the proposed restrictions on the use of leaded gasoline.

1 INTRODUCTION

This report addresses some of the impacts (in terms of benefits and costs) to minority* and low-income† households because of the reduced use of lead in gasoline proposed by the U.S. Environmental Protection Agency (EPA). Section 2 provides a background for the EPA proposals and some of the important issues that affect minority and low-income households. Section 3 discusses benefits that these households could receive from the EPA's proposals, and Section 4 discusses potential costs to the households. No attempt is made to monetize the benefits and costs, but their relationships to those for the overall U.S. population are compared. Section 4 also provides projections of the numbers of leaded gasoline vehicles at the times that the EPA proposals would take effect. Sections 3 and 4 include data for the U.S. (for the 48 contiguous states; Alaska and Hawaii are not included) and the four census regions (see Figure 1). Section 5 identifies households by both benefits and costs in terms of vehicle ownership, age of children, and spatial patterns.



FIGURE 1 U.S. Census Regions for the 48 Contiguous States

*This report focuses on black and Hispanic minority groups (see Appendix A).

†Low-income households have annual incomes of less than 125% of the poverty level (see Appendix B).

The data used in this analysis are from the Residential Energy Consumption Surveys taken in 1980-1981 (RECS1) and 1981-1982 (RECS2).^{1,2} Experience with these data has revealed some limitations regarding the spatial distribution of minority households. In particular, the surveys overestimate the number of black households living in central cities of Standard Metropolitan Statistical Areas (SMSAs) of the Northeast census region. Methods for adjusting the difference between expanded RECS1 and RECS2 totals and census population and households counts are being investigated. Counts of black SMSA central city households in this report are slightly high, while those of other groups are low. Appendix A discusses the sample size for the RECS2 survey, which was used to develop all but one of the tables in this report. The RECS1 survey is similar to RECS2 but used a slightly smaller sample.

2 BACKGROUND

2.1 CHRONOLOGY OF LEADED GASOLINE REGULATION

In 1970 the EPA was given authority by the Clean Air Act (42 U.S.C. §1857 et seq.) to control the use of any fuel or fuel additive that would cause or increase air pollution that would adversely affect the health or welfare of the public or that would prevent, to a significant degree, proper functioning of an emission control device.

With this authority, EPA required a gradual tightening of emission standards for new motor vehicles. The purpose of the standards was to reduce emissions of air pollutants such as hydrocarbons, carbon monoxide, and nitrogen oxides. To meet the tightening standards, vehicle manufacturers began installing catalytic converters on some of their new models beginning in 1975.

EPA began to restrict the lead content of gasoline in 1973, originally to reduce the adverse effects of lead in the environment and, later, to protect catalytic converters from being "poisoned" by lead. Leaded gasoline will incapacitate the converter so that it will no longer function properly, resulting in significantly higher emissions. Thus, vehicles equipped with catalytic converters require the use of lead-free gasoline.

The purpose of adding lead to gasoline is to increase the octane rating and thus reduce engine knock. Some older vehicles also require lead in gasoline to lubricate engine valves. Achieving a specific octane rating without using lead (as in the case of unleaded gasoline) results in slightly higher refining costs. Because of this additional cost and also because of marketing decisions by the gasoline retailers, unleaded gasoline has a higher retail price than leaded gasoline. Since unleaded gasoline is less corrosive to the vehicle's engine, motorists using unleaded gasoline benefit from reduced vehicle maintenance costs in comparison to those using leaded gasoline. Vehicles using unleaded gasoline require less frequent tune-ups, exhaust system replacements, and oil changes. This, of course, is in addition to the overall benefit from a reduction of adverse environmental effects because of reduced emissions.

Some motorists "misfuel" their cars with the lower-priced leaded gasoline in the belief that it will result in greater performance expected from the higher octane; the lower price is also a consideration. Research by EPA indicates that 12% or more of the vehicles designed to use unleaded gasoline are being misfueled.³ As a result, EPA became concerned that its timetable for reducing vehicle emissions was in danger of not being met. Moreover, the health effects of lead from vehicle emissions became an increasing concern for EPA, because a growing body of research suggested a correlation between leaded gasoline use and adverse health effects.

Because of these developments, EPA recently conducted a benefit-and-cost analysis of the elimination or reduction of lead in gasoline.³ In its analysis, EPA examined two alternative proposals. One proposal would reduce the maximum allowable lead content from the current level of 1.1 grams of lead per gallon of leaded gasoline (gplg) to 0.1 gplg. This would allow older vehicles continued access to gasoline with sufficient lead to lubricate engine valves, preventing possible costly engine damage.

Because required octane levels must be maintained, this new low-lead gasoline would be likely to cost more than unleaded gasoline because of higher refining costs. This would remove the price incentive to misfuel vehicles equipped with a catalytic converters. (Some vehicles without converters can use unleaded gasoline with no harm to their engines; owners of these vehicles would have an economic incentive to use unleaded gasoline with this proposal.) The EPA subsequently announced that it is considering implementation of this proposal⁴ beginning on January 1, 1986.*

The second proposal would prohibit the sale of leaded gasoline by the mid-1990s. In this case, all vehicles now using leaded gasoline would have to use unleaded gasoline. While this would eliminate misfueling, it could also result in premature engine wear in some vehicles designed to use leaded gasoline. The EPA has indicated that this proposal is being considered for the mid-1990s.⁴

An optional approach being considered by EPA is a gradual phasedown of the amount of lead in gasoline. The level would be lowered gradually until it reached 0.1 gplg by 1988. The effects of this approach would be similar to those of the first proposal described above.⁴

2.2 EPA VIEWS ON HEALTH BENEFITS DUE TO REDUCED LEAD IN GASOLINE

In its benefit-and-cost study, EPA considered benefits from three sources: (1) reduced vehicle maintenance (less frequent tune-ups, etc.), (2) reduced emission of other pollutants (HC, CO, and NO_x) through proper operation of the catalytic converter, and (3) health benefits through reduced lead in the environment. The third benefit is the focus of this report.

Before discussing the effects of lead in the blood of individuals, EPA attempted to determine the relationship between the use of leaded gasoline and blood-lead levels. Evidence was presented that, according to EPA, shows "...persuasively that blood lead levels for a given age group will fall as gasoline lead content falls."³ The analysis was most concerned with small children (i.e., those under the age of seven). The EPA contended that elevated blood-lead levels in small children were due to lead from gasoline and that "[e]xternal estimates of environmental lead from other sources clearly indicated that paint and other dietary lead were *not* the primary sources of the observed decline in blood lead levels" (emphasis in original).³ The agency cited a "highly significant" regression coefficient from a study that related the use of gasoline lead to blood-lead levels with a corresponding correlation coefficient of 0.95, which, EPA states, demonstrates a strong relationship between leaded gasoline use and blood-lead levels.³

*In March 1985 (after completion of this report), EPA promulgated a final rule on a low-lead standard of 0.1 gplg effective January 1, 1986, with an interim standard of 0.5 gplg effective July 1, 1985.⁵

A second question is whether elevated blood-lead levels have adverse health effects on population groups. Here, EPA focused its analysis on children, who are more vulnerable to lower levels of exposure than are adults. EPA states that:

Children, as a class, are most at risk from all sources of lead -- inhaled or ingested. Small children who crawl and "mouth" objects and hands are especially likely to ingest lead. Fetuses and young children are more vulnerable than the population as a whole. The absorption and retention rates, and the partitioning of lead in hard and soft tissues all contribute to the fact that children possess greater lead body burdens for a given exposure. Children have also been shown to display a greater sensitivity to lead toxicity, and their inability to recognize symptoms may make them especially vulnerable. In the late 1970's data indicated that well over 10% of black children had blood lead levels above 30 $\mu\text{g}/\text{dL}$.³

The report points out that "[b]lood lead levels above 30 $\mu\text{g}/\text{dL}$ (micrograms per deciliter) are associated with adverse cognitive effects, anemia, kidney damage, hypertension, and other pathophysiological consequences."³ In monetizing the benefits from a reduction of gasoline-derived lead to which children are exposed, EPA estimated the costs that would be avoided in association with these pathophysiological effects.

The EPA calculated that if leaded gasoline was banned by 1988, 45,000 fewer children would have blood-lead levels above 30 $\mu\text{g}/\text{dL}$ than if the current situation continued. If the low-level option was adopted, there would be 43,000 fewer children above 30 $\mu\text{g}/\text{dL}$ in 1988. Using these estimates of the number of children, together with estimates of cost savings from fewer medical tests and treatments, EPA arrived at the monetized benefit due to the lower number of children with blood lead levels above 30 $\mu\text{g}/\text{dL}$.

The agency also estimated the change in the number of children at risk of cognitive effects, in terms of (1) possible changes in test scores and (2) hematological and neurological effects at blood-lead levels between 10 and 30 $\mu\text{g}/\text{dL}$. In this case, however, EPA made no attempt to monetize the possible benefits from reduced lead in gasoline. However, it points out that "...the social costs (to the individuals affected and society as a whole) associated with even low blood lead levels is probably substantial."³ It appears that EPA's position is that any reduction of lead in leaded gasoline would be substantially beneficial.

2.3 OTHER VIEWS ON HEALTH BENEFITS

Not all researchers support EPA's conclusions. To illustrate this point and to indicate some of its implications, we examined some research sponsored by the Ethyl Corporation. Reviewing the research used in EPA's report, Ethyl came to very different conclusions about the magnitude of the effect of gasoline-derived lead on blood lead levels and about the health effects from relatively low levels of lead in blood.

Ethyl Corporation, after reviewing one of the studies relied upon by EPA in its report, argues that the conclusion that most of the reduction in the amount of blood-lead levels was attributable to reduced lead in gasoline is overstated. Ethyl put the additional contribution of lead in gasoline to blood-lead levels at 14% of blood-lead levels⁶ and states that the actual figure is "no doubt" even lower due to the lack of additional information on the contribution to blood-lead levels from other sources. This disputes the EPA conclusion, based on the "highly significant" regression coefficient from the data source, that there is a causal relationship between the reduction in the use of leaded gasoline and the reduction in blood-lead levels.

Ethyl also disputes EPA's conclusion (and the studies cited in EPA's report) that there are negative cognitive effects due to low levels of blood lead. Ethyl concluded:

...the review of studies of effects on behavior and intelligence at low to moderately elevated blood-lead levels supports the conclusion that adverse effects do not occur, or if they do occur, are so minimal as to be of no health consequence.⁷

2.4 SUMMARY

This brief review shows that EPA's proposed actions with regard to leaded gasoline are controversial. It also points out that the findings presented by EPA, Ethyl Corporation, and others are based primarily on statistical analyses using sample data and are thus subject to the uncertainty inherent in such analyses. A number of assumptions were made, based on the background issues presented in the preceding discussion, to measure how the costs and benefits due to banning or reducing lead in gasoline might be allocated. It is assumed that there is some relationship between blood-lead levels and use of leaded gasoline. (Ethyl agreed that the use of leaded gasoline contributes to blood-lead levels, but to a much smaller degree than that presented by EPA.) Therefore, a reduction of lead in gasoline would reduce blood-lead levels generally. It is also assumed that elevated blood-lead levels have a negative impact on the health of small children. Because no attempt is made to monetize the benefit of the EPA proposals, the magnitude of the health impact is not addressed. Finally, it is assumed that, in general, there is more vehicle travel in a given area in SMSA central cities than in similar areas outside SMSA central cities, and that lead emissions do not travel far from the original source. Consequently, SMSA central city populations have higher levels of exposure to gasoline-derived lead than do populations outside central cities. These assumptions are used in the following section, which deals with the benefits to minority and low-income households from the EPA proposals.

3 BENEFITS TO MINORITY AND LOW-INCOME HOUSEHOLDS FROM REDUCED LEAD IN GASOLINE

As discussed in the previous section, population groups living in SMSA central cities where the traffic density is assumed to be greater than that of areas outside the central cities will tend to have a greater exposure to lead (and other pollutants) from vehicle emissions. Therefore, groups that are more concentrated in central cities will benefit proportionately more from the reduction of lead in gasoline than will the population as a whole.

In this section, minority and low-income households (those with incomes less than 125% of the poverty level) are examined in terms of spatial patterns and the presence of small children (children under seven years of age) relative to the general population. Also examined is the number of small children in households in central cities by race and income for the U.S. as a whole (the 48 contiguous states) and for the four census regions.

3.1 HOUSEHOLDS BY RACE AND INCOME

To provide a backdrop for a discussion of small children (the population group considered the most sensitive to elevated blood-lead levels), general racial, income, and spatial patterns of households in the U.S. and the four census regions are discussed. Table 1 is a breakdown of all households by race, income, and location. Table 2 presents

TABLE 1 Households by Race, Income, and Location, 1981

| Population Category | National ^a | | Northeast | | North Central | | South | | West ^b | |
|------------------------|---|--------------------------------|---|--------------------------------|---|--------------------------------|---|--------------------------------|---|--------------------------------|
| | No. of House- holds (10 ⁶) | % of All House- holds | No. of House- holds (10 ⁶) | % of All House- holds | No. of House- holds (10 ⁶) | % of All House- holds | No. of House- holds (10 ⁶) | % of All House- holds | No. of House- holds (10 ⁶) | % of All House- holds |
| Total | 82.72 | 100.0 | 17.93 | 100.0 | 21.24 | 100.0 | 27.69 | 100.0 | 15.86 | 100.0 |
| White | 68.23 | 82.5 | 14.73 | 82.2 | 19.38 | 91.2 | 21.85 | 78.9 | 12.27 | 77.4 |
| Black | 8.89 | 10.8 | 2.01 | 11.2 | 1.36 | 6.4 | 4.42 | 16.0 | 1.10 | 6.9 |
| Hispanic | 4.50 | 5.4 | 0.86 | 4.8 | 0.41 | 1.9 | 1.22 | 4.4 | 2.01 | 12.7 |
| Other | 1.09 | 1.3 | 0.33 | 1.8 | 0.09 | 0.4 | 0.20 | 0.7 | 0.48 | 3.0 |
| Low Income | 15.75 | 19.0 | 2.57 | 14.4 | 4.00 | 18.9 | 6.30 | 77.3 | 2.87 | 18.1 |
| Other | 66.97 | 81.0 | 15.35 | 85.6 | 17.23 | 81.1 | 21.39 | 22.7 | 12.99 | 81.9 |
| SMSA Central City | 24.60 | 29.97 | 6.00 | 33.5 | 5.87 | 27.6 | 7.36 | 26.6 | 5.38 | 33.9 |
| SMSA Other | 32.02 | 38.7 | 8.12 | 45.3 | 8.00 | 37.7 | 8.47 | 30.6 | 7.44 | 46.9 |
| Non-SMSA | 26.09 | 31.5 | 3.81 | 21.2 | 7.37 | 34.7 | 11.86 | 42.8 | 3.05 | 19.2 |

^aThe 48 contiguous states.

^bExcludes Alaska and Hawaii.

Source: Ref. 2.

TABLE 2 SMSA Central City Households by Race and Income, 1981

| Population Category | National ^a | | Northeast | | North Central | | South | | West ^b | |
|---------------------|--------------------------------------|---------------------|--------------------------------------|---------------------|--------------------------------------|---------------------|--------------------------------------|---------------------|--------------------------------------|---------------------|
| | No. of Households (10 ⁶) | % of All Households | No. of Households (10 ⁶) | % of All Households | No. of Households (10 ⁶) | % of All Households | No. of Households (10 ⁶) | % of All Households | No. of Households (10 ⁶) | % of All Households |
| Total | 24.60 | 100.0 | 6.00 | 100.0 | 5.87 | 100.0 | 7.36 | 100.0 | 5.38 | 100.0 |
| White | 17.15 | 69.7 | 3.69 | 61.4 | 4.52 | 77.1 | 5.15 | 70.0 | 3.79 | 70.6 |
| Black | 4.76 | 19.3 | 1.49 | 24.8 | 1.10 | 18.8 | 1.61 | 21.9 | 0.55 | 10.2 |
| Hispanic | 2.09 | 8.5 | 0.57 | 9.5 | 0.19 | 3.2 | 0.57 | 7.7 | 0.77 | 14.3 |
| Other | 0.60 | 2.4 | 0.26 | 4.3 | 0.05 | 0.8 | 0.03 | 0.4 | 0.26 | 4.9 |
| Low Income | 5.49 | 22.3 | 1.25 | 20.8 | 1.49 | 25.4 | 1.55 | 21.1 | 1.20 | 22.2 |
| Other | 19.12 | 77.7 | 4.75 | 79.2 | 4.38 | 74.6 | 5.81 | 78.9 | 4.18 | 77.8 |

^aThe 48 contiguous states.^bExcludes Alaska and Hawaii.

Source: Ref. 2.

SMSA central city households by race and income. Figure 2 (based on data in Table 1) indicates where U.S. households are located. Figure 3 (from Table 2) shows SMSA central city households by race and income.

Nationally, the proportions of minority and low-income households are higher in SMSA central cities than in the nation as a whole. For the country as a whole, 17.5% of all households were minority and 19.0% of all households were low-income; in SMSA central cities, however, 30.2% of the households were minority and 22.3% were low-income. The same is true in all four of the census regions. Based on the assumptions made in Section 2, this implies a greater exposure to lead from leaded gasoline for minority and low-income households in SMSA central cities than for the same households elsewhere in the nation. The next step is to analyze the SMSA central city households with small children, which is the population group assumed to be most at risk from exposure to gasoline-derived lead.

3.2 CENTRAL CITY HOUSEHOLDS WITH SMALL CHILDREN

Table 3 presents SMSA central city households with small children for the nation and the four census regions. Of the more than 5.5 million such households in the U.S., 47.0% were minority and 34.5% were low-income.

Table 4 indicates how these central city households are distributed by age of children. The share of minority and low-income households with small children in central cities is higher than that for all households in central cities. Again, because a higher percentage of SMSA central city households are minority and low-income and have small children, these households would benefit proportionately more from a reduction of lead in gasoline than would the population as a whole.

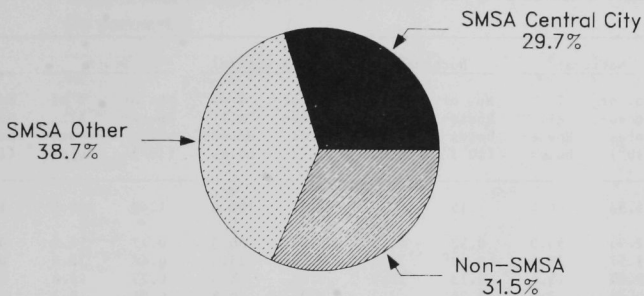


FIGURE 2 National Households by Location, 1981

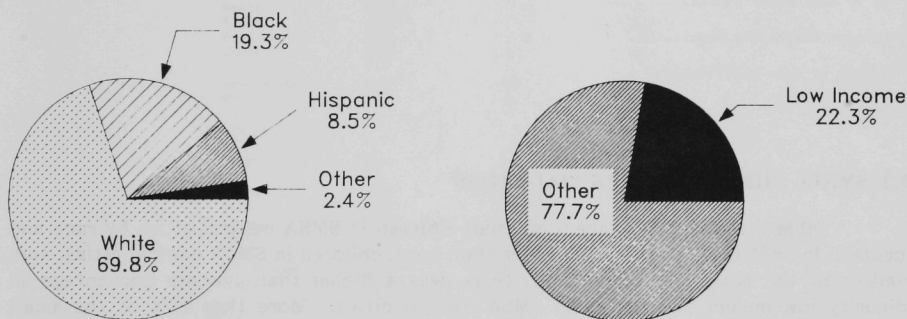


FIGURE 3 SMSA Central City Households by Race (left) and Income (right), 1981

The same is true in each of the four census regions. In all but one case ("Other" in the North Central region), the percentages of minority and low-income households with small children in SMSA central cities are higher than the regional average. Thus, regionally as well as nationally, minority and low-income households have a higher percentage of small children exposed to lead from vehicles using leaded gasoline than do other households.

Figure 4 highlights the percentages of households in SMSA central cities with small children, by race and household income level. Figures 5 and 6 present SMSA central city households with small children, by race and household income, as a percentage of the respective populations.

TABLE 3 SMSA Central City Households with Children under Seven Years of Age, 1981

| Population Category | National ^a | | Northeast | | North Central | | South | | West ^b | |
|---------------------|--------------------------------------|---------------------|--------------------------------------|---------------------|--------------------------------------|---------------------|--------------------------------------|---------------------|--------------------------------------|---------------------|
| | No. of Households (10 ⁶) | % of All Households | No. of Households (10 ⁶) | % of All Households | No. of Households (10 ⁶) | % of All Households | No. of Households (10 ⁶) | % of All Households | No. of Households (10 ⁶) | % of All Households |
| Total | 5.53 | 100.0 | 1.15 | 100.0 | 1.37 | 100.0 | 1.49 | 100.0 | 1.53 | 100.0 |
| White | 2.93 | 53.0 | 0.52 | 45.5 | 0.83 | 60.3 | 0.77 | 51.5 | 0.82 | 53.5 |
| Black | 1.57 | 28.3 | 0.42 ^c | 36.4 | 0.46 | 33.6 | 0.48 | 32.4 | 0.21 | 13.7 |
| Hispanic | 0.85 | 15.4 | 0.13 | 10.9 | 0.07 | 5.3 | 0.23 | 15.4 | 0.42 ^c | 27.7 |
| Other | 0.18 | 3.3 | 0.08 | 7.2 | 0.01 | 0.8 | 0.01 | 0.7 | 0.08 | 5.1 |
| Low Income | 1.91 | 34.5 | 0.37 | 32.6 | 0.56 | 41.0 | 0.52 | 34.8 | 0.46 | 29.9 |
| Other | 3.62 | 65.5 | 0.77 | 67.4 | 0.81 | 59.0 | 0.97 | 65.2 | 1.07 | 70.1 |

^aThe 48 contiguous states.^bExcludes Alaska and Hawaii.^cSubject to data verification.

Source: Ref. 2.

3.3 SMALL CHILDREN IN CENTRAL CITIES

Table 5 shows the numbers of small children in SMSA central cities by race and income. In 1981 there were almost 7.6 million small children in SMSA central cities; and, similar to the household proportions, there was a higher-than-average percentage in minority low-income households in SMSA central cities. More than 50% of the small children in SMSA central cities were minority, and nearly 40% were in low-income households.

3.4 SUMMARY

It appears that minority households tend to be located in central cities and that a relatively high percentage of them have small children. Consequently, minority and low-income households would benefit proportionally more from a reduction of lead in gasoline.

TABLE 4 Distribution of SMSA Central City Households by Age of Children, 1981 (in percent)

| Region and Population Category | Households with Small Children (under age 7) | Households with Older Children Only | Childless Households |
|--------------------------------|--|-------------------------------------|----------------------|
| <u>National^a</u> | | | |
| Total | 22.5 | 17.2 | 60.3 |
| White | 17.1 | 14.9 | 68.1 |
| Black | 33.0 | 21.9 | 45.2 |
| Hispanic | 40.6 | 25.5 | 33.9 |
| Other | 30.2 | 17.8 | 52.0 |
| Low Income | 34.8 | 17.1 | 48.0 |
| Other | 19.0 | 17.2 | 63.9 |
| <u>Northeast</u> | | | |
| Total | 19.1 | 16.2 | 64.6 |
| White | 14.2 | 11.3 | 74.5 |
| Black | 28.1 ^b | 23.1 | 48.8 |
| Hispanic | 22.0 | 27.8 | 50.2 |
| Other | 31.8 | 21.7 | 46.5 |
| Low Income | 29.9 | 15.1 | 55.0 |
| Other | 16.3 | 16.5 | 67.2 |
| <u>North Central</u> | | | |
| Total | 23.4 | 17.4 | 59.2 |
| White | 18.3 | 16.1 | 65.6 |
| Black | 41.7 | 21.0 | 37.4 |
| Hispanic | 38.8 | 26.6 | 34.6 |
| Other | 22.3 | 21.7 | 55.9 |
| Low Income | 37.9 | 21.3 | 40.8 |
| Other | 18.5 | 16.0 | 65.5 |
| <u>South</u> | | | |
| Total | 20.2 | 18.4 | 61.5 |
| White | 14.9 | 16.5 | 68.6 |
| Black | 29.8 | 23.2 | 47.1 |
| Hispanic | 40.4 | 22.4 | 37.2 |
| Other | 33.6 | - ^c | 66.4 |
| Low Income | 33.3 | 17.8 | 48.9 |
| Other | 16.7 | 18.5 | 64.8 |
| <u>West^d</u> | | | |
| Total | 28.4 | 16.4 | 55.2 |
| White | 21.5 | 14.5 | 63.9 |
| Black | 37.9 | 16.6 | 45.5 |
| Hispanic | 55.0 ^b | 25.8 | 19.3 |
| Other | 29.7 | 15.1 | 55.3 |
| Low Income | 38.2 | 13.1 | 48.7 |
| Other | 25.6 | 17.3 | 57.1 |

^aThe 48 contiguous states.

^bSubject to data verification.

^cNo households in RECS data for this category.

^dExcludes Alaska and Hawaii.

Source: Ref. 2.

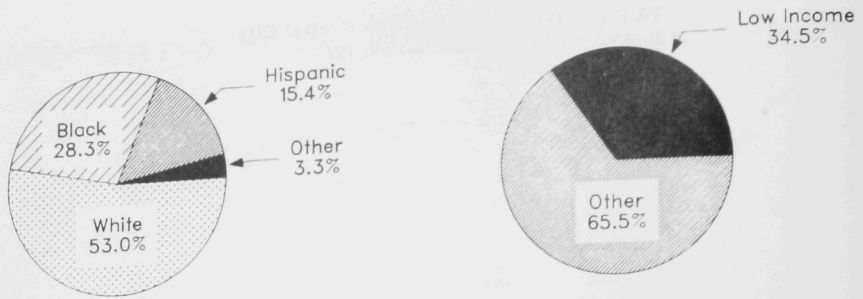


FIGURE 4 Percentages of SMSA Central City Households with Small Children, by Race (left) and Household Income (right), 1981

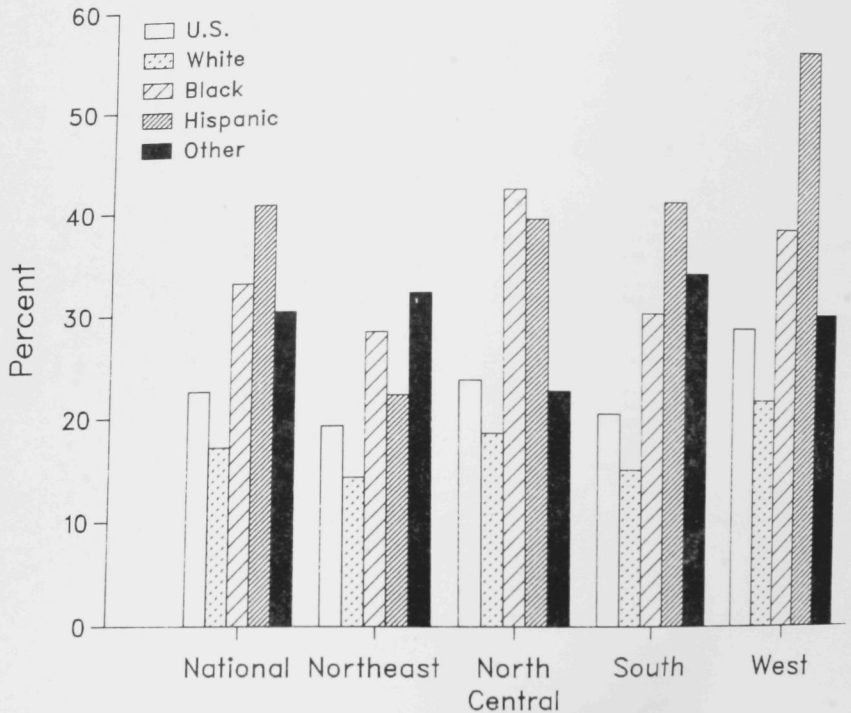


FIGURE 5 SMSA Central City Households with Small Children, by Race, 1981, as a Percentage of the Respective Populations

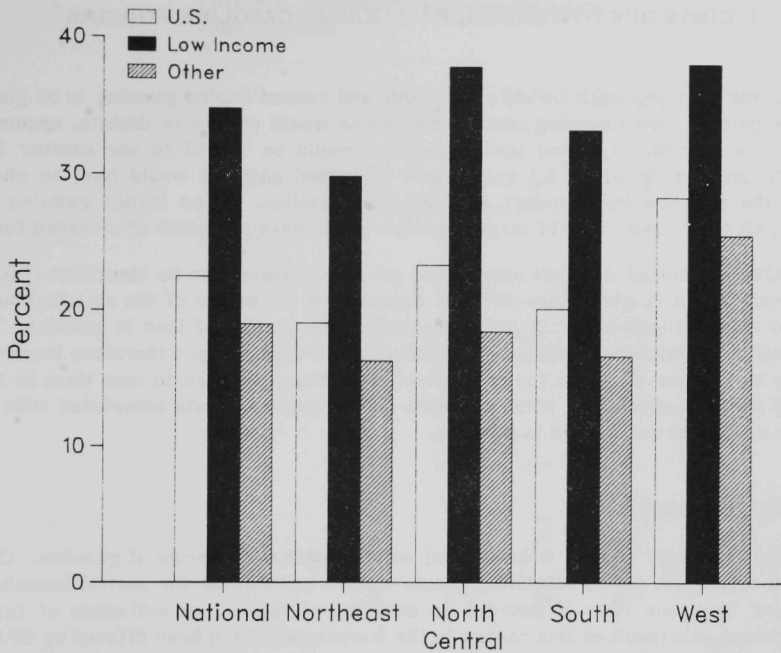


FIGURE 6 SMSA Central City Households with Small Children, by Household Income, 1981, as a Percentage of the Respective Populations

TABLE 5 Small Children in SMSA Central Cities, 1981

| Population Category | National ^a | | Northeast | | North Central | | South | | West ^b | |
|---------------------|--|-------|--|-------|--|-------|--|-------|--|-------|
| | No. of Small Children (10 ⁶) | % | No. of Small Children (10 ⁶) | % | No. of Small Children (10 ⁶) | % | No. of Small Children (10 ⁶) | % | No. of Small Children (10 ⁶) | % |
| Total | 7.59 | 100.0 | 1.62 | 100.0 | 1.89 | 100.0 | 1.98 | 100.0 | 2.10 | 100.0 |
| White | 3.76 | 49.6 | 0.66 | 40.9 | 1.04 | 55.0 | 0.95 | 47.9 | 1.11 | 53.0 |
| Black | 2.44 | 32.2 | 0.73 ^c | 45.1 | 0.73 ^c | 38.7 | 0.72 | 36.1 | 0.26 | 12.6 |
| Hispanic | 1.16 | 15.2 | 0.15 | 8.9 | 0.11 | 5.7 | 0.31 | 15.5 | 0.60 ^c | 28.4 |
| Other | 0.23 | 3.0 | 0.08 | 5.1 | 0.01 | 0.6 | 0.01 | 0.5 | 0.13 | 6.0 |
| Low Income | 2.96 | 39.0 | 0.67 | 41.3 | 0.80 | 42.4 | 0.79 | 39.8 | 0.70 | 33.4 |
| Other | 4.63 | 61.0 | 0.95 | 58.7 | 1.09 | 57.6 | 1.19 | 60.2 | 1.40 | 66.6 |

^a The 48 contiguous states.

^b Excludes Alaska and Hawaii.

^c Subject to data verification.

Source: Ref. 2.

4 COSTS DUE TO OWNERSHIP OF LEADED GASOLINE VEHICLES

If the EPA proposals became standards and caused leaded gasoline to be phased out more quickly than changing market conditions would otherwise dictate, owners of vehicles now legitimately using leaded gasoline would be forced to use another fuel. Under the proposal to allow 0.1 gplg, users of leaded gasoline would have to choose between the new low-lead product and unleaded gasoline. If no leaded gasoline was available, all the former users of leaded gasoline would have to switch to unleaded fuel.

Although households that own leaded gasoline vehicles can be identified (Table 6 and Appendix C), it is much more difficult to estimate the nature of the cost that would accrue to these households from the reduction or elimination of lead in gasoline. The characteristics of households that own leaded gasoline vehicles (and therefore those that are likely to bear costs during the phasedown) and those expected to own them in 1986 and 1988 are discussed after a brief review of the possible costs associated with the reduction or elimination of lead in gasoline.

4.1 COSTS TO HOUSEHOLDS

The first type of cost is associated with changes in the price of gasoline. Once prices are estimated, it is a relatively simple matter to estimate the cost to households of changing from one type of gasoline to another. However, no estimates of future gasoline prices as a result of this change in the marketplace have been offered by EPA or others. In the absence of such price forecasts, several reasonable situations are described below.

First, in the case of a complete phaseout of lead in gasoline, the price of unleaded gasoline could fall below the price charged earlier for leaded gasoline. For vehicles able to use standard, 87-octane unleaded gasoline without octane enhancement, gasoline expenditures would actually drop. This could apply to 50% of the vehicles that now use leaded gasoline because engines in most vehicles built after 1971 do not require leaded gasoline for valve lubrication. By 1981, vehicles manufactured after 1971 using leaded gasoline represented about 60% of all vehicles in use. Other vehicles might need higher octane blends that would likely be priced higher than the pre-phaseout price of leaded gasoline.

In the second case, all gasolines could be priced higher than leaded gasoline. In this situation, all legitimate users of leaded fuel would be affected by higher costs.

In the third case, the price of unleaded gasoline could be lower than that for gasoline with 1.1 gplg but the latter could be priced higher. Some of the price difference between low-lead and unleaded gasoline might be due to higher production costs for the low-lead fuel; the rest could be attributed to a small and shrinking market for leaded gasoline. As in the first case, vehicles that could successfully use unleaded gasoline would have lower gasoline expenditures, while vehicles that require lead in their gasoline as a valve lubricant (primarily those manufactured before 1972) would have higher expenditures.

TABLE 6 Households with Leaded Gasoline Vehicles, 1981

| Region and Population Category | Households Owning Leaded Gasoline Vehicles | | Households Owning Only Leaded Gasoline Vehicles | |
|--------------------------------|--|-------|---|-------|
| | No. of Households (10 ⁶) | % | No. of Households (10 ⁶) | % |
| <u>National^a</u> | | | | |
| Total | 47.83 | 100.0 | 24.07 | 100.0 |
| White | 40.65 | 85.0 | 19.60 | 81.4 |
| Black | 4.06 | 8.5 | 2.60 | 10.8 |
| Hispanic | 2.59 | 5.4 | 1.55 | 6.5 |
| Other | 0.53 | 1.1 | 0.32 | 1.3 |
| Low Income | 7.08 | 14.8 | 5.56 | 23.1 |
| Other | 40.76 | 85.2 | 18.51 | 76.9 |
| <u>Northeast</u> | | | | |
| Total | 8.70 | 100.0 | 4.53 | 100.0 |
| White | 7.50 | 86.1 | 3.77 | 83.1 |
| Black | 0.80 | 9.2 | 0.42 | 9.2 |
| Hispanic | 0.32 | 3.6 | 0.25 | 5.5 |
| Other | 0.10 | 1.1 | 0.10 | 2.1 |
| Low Income | 0.80 | 9.2 | 0.67 | 14.7 |
| Other | 7.91 | 90.8 | 3.87 | 85.3 |
| <u>North Central</u> | | | | |
| Total | 12.00 | 100.0 | 5.54 | 100.0 |
| White | 11.08 | 92.3 | 4.92 | 88.7 |
| Black | 0.63 | 5.3 | 0.48 | 8.6 |
| Hispanic | 0.21 | 1.8 | 0.12 | 2.2 |
| Other | 0.08 | 0.7 | 0.03 | 0.5 |
| Low Income | 1.81 | 15.1 | 1.41 | 25.4 |
| Other | 10.19 | 84.9 | 4.13 | 74.6 |
| <u>South</u> | | | | |
| Total | 16.23 | 100.0 | 8.23 | 100.0 |
| White | 13.41 | 82.7 | 6.62 | 80.5 |
| Black | 1.98 | 12.2 | 1.23 | 15.0 |
| Hispanic | 0.75 | 4.6 | 0.33 | 4.1 |
| Other | 0.09 | 0.6 | 0.04 | 0.5 |
| Low Income | 3.00 | 18.5 | 2.32 | 28.2 |
| Other | 13.23 | 81.5 | 5.91 | 71.8 |
| <u>West^b</u> | | | | |
| Total | 10.90 | 100.0 | 5.76 | 100.0 |
| White | 8.67 | 79.6 | 4.29 | 74.4 |
| Black | 0.66 | 6.0 | 0.47 | 8.2 |
| Hispanic | 1.31 | 12.0 | 0.85 | 14.7 |
| Other | 0.26 | 2.4 | 0.15 | 2.7 |
| Low Income | 1.47 | 13.5 | 1.16 | 20.2 |
| Other | 9.43 | 86.5 | 4.60 | 79.8 |

^aThe 48 contiguous states.^bExcludes Alaska and Hawaii.

Source: Ref. 2.

This review of possible gasoline price changes indicates the high degree of uncertainty in assessing gasoline prices. While production costs are one factor, market conditions are generally of greater significance in determining gasoline prices. (In 1984, the production cost difference between leaded and unleaded gasoline was 1 to 2¢/gal, while the retail pump price difference between the two grades was 7¢/gal on average.⁸)

Other costs may also accrue to owners of leaded gasoline vehicles because of the proposed phasedown of lead. These costs are very difficult to quantify, as EPA has demonstrated. They are related to engine wear and are balanced by possible reductions in maintenance expenditures such as spark plug replacement and oil changes. Accurate assessment of these costs requires knowledge of current maintenance practices by owners of older vehicles and of factors contributing to engine failure; much remains to be learned about both of these. One conclusion is that some net costs would be likely to arise for some fraction of those leaded gasoline vehicles operating when lead in gasoline was reduced or eliminated. Pre-1972 vehicles (and certain heavy-duty engines not generally used in household vehicles) would be more likely to be subject to these effects than post-1971 vehicles that could use leaded gasoline but do not require it to prevent engine wear. Vehicles manufactured in 1971 would be 16 years old at the earliest date for implementing the phasedown of lead in gasoline. This highlights the continuing decline in the number of vehicles requiring leaded gasoline. It does not, however, address the improper use of leaded gasoline in vehicles designed to operate on unleaded gasoline.

4.2 INCIDENCE OF COSTS

Costs related to reduced use of lead in gasoline would not fall on everyone. Households with vehicles that can use leaded gasoline (Table 6) would be more likely to experience costs. Of the 47.8 million households with leaded gasoline vehicles in 1981 (this number decreases every year as some of these vehicles are scrapped), 85% are classified as white and 77% have incomes above 125% of the poverty level (see Appendix B). By census region, the share of white households with leaded gasoline vehicles is higher than average in the North Central (92%) and Northeast (86%) regions and lower in the South (83%) and West (80%). In the South, households with leaded gasoline vehicles are more likely to be low-income (with incomes below 125% of the poverty level) than in any other region.

Also shown in Table 6 are households that own *only* leaded gasoline vehicles -- 24.1 million in 1981, or about half of all households owning leaded gasoline vehicles. The distribution of these households is shown in Figure 7. These households would experience the full effect of any cost burden and could not make the simple adjustment of shifting to the use of other household vehicles that operate on unleaded gasoline.

In Table 7, the distribution of vehicle ownership by gasoline type in 1981 is shown. Every type of household has leaded gasoline vehicles, and in each region black households are less likely than white households to have such vehicles (this includes households with both leaded and unleaded vehicles). This is also true, to a lesser extent, for Hispanic households. In some cases, Hispanic households are more likely than any other group to have only leaded gasoline vehicles.

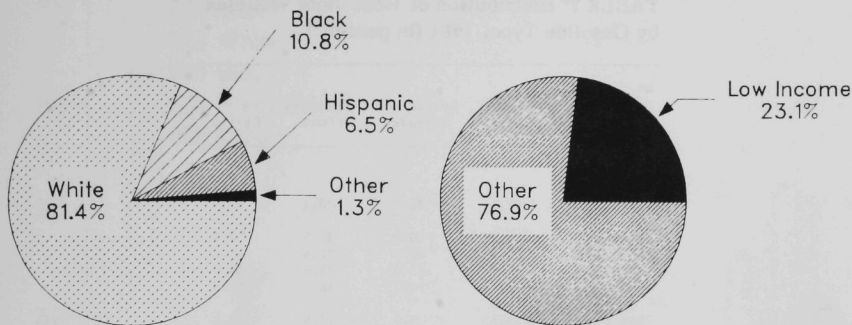


FIGURE 7 Households Owning Only Leaded Gasoline Vehicles, by Race (left) and Income (right), 1981

The national share of each group owning only leaded gasoline vehicles is shown in Figure 8. The regions relate to the national average as before, but the share of white households owning *only* leaded gasoline vehicles is 3% to 10% lower, indicating that minority households are somewhat more likely to have *only* leaded gasoline vehicles than are white households, if the household has any leaded gasoline vehicles.

In Figure 9, the national share of households with leaded gasoline vehicles is shown for low-income households relative to all households. The greater tendency for these households in the West to own only leaded gasoline vehicles is shown in this figure. The majority of households with these vehicles are in the South and West regions.

Part of the reason for low rates of minority ownership of leaded gasoline vehicles is the general tendency of these households to not own vehicles at all. Carless households are two to four times more prevalent among minorities than among whites. There is little regional variation in the relative position of black and Hispanic households relative to white households in this respect, although there are general differences between regions. Carless households are generally more typical in the Northeast and are least common in the North Central and West regions. The share of carless black households is about one-third in every region but the West. There are fewer black households in the West, however (about 12% of all black households live in the West, which is equivalent to almost 7% of that region's households).

Among Hispanic households, those least likely to have a vehicle live in the Northeast. In the other three regions, numbers of carless Hispanic households are substantially lower and much closer to (but always higher than) those of white carless households.

The carless rates for low-income households, as expected, are very high. The rate is highest in the Northeast region (56%), which is influenced by the New York

**TABLE 7 Distribution of Household Vehicles
by Gasoline Type, 1981 (in percent)**

| Region and Population Category | Leaded Only | Leaded and Unleaded | Unleaded Only | Carless |
|--------------------------------------|----------------|------------------------|------------------|---------|
| <u>National^a</u> | | | | |
| Total | 29.1 | 28.7 | 30.1 | 12.0 |
| White | 28.7 | 30.9 | 31.5 | 8.9 |
| Black | 29.2 | 16.4 | 21.4 | 32.9 |
| Hispanic | 34.5 | 22.9 | 24.6 | 18.0 |
| Other | 29.1 | 19.3 | 38.1 | 13.5 |
| Low Income | 35.3 | 9.6 | 17.9 | 37.1 |
| Other | 27.6 | 33.2 | 33.0 | 6.1 |
| <u>Northeast</u> | | | | |
| Total | 25.3 | 23.3 | 34.4 | 17.0 |
| White | 25.6 | 25.3 | 36.1 | 13.0 |
| Black | 20.8 | 18.9 | 22.7 | 37.6 |
| Hispanic | 29.0 | 7.5 | 21.0 | 42.6 |
| Other | 29.5 | - ^b | 66.4 | 4.1 |
| Low Income | 25.9 | 5.1 | 13.5 | 55.5 |
| Other | 25.2 | 26.3 | 37.9 | 10.6 |
| <u>North Central</u> | | | | |
| Total | 26.1 | 30.4 | 34.1 | 9.4 |
| White | 25.4 | 31.8 | 35.2 | 7.7 |
| Black | 34.9 | 11.5 | 21.5 | 32.1 |
| Hispanic | 29.9 | 22.2 | 32.0 | 15.9 |
| Other | 30.0 | 62.4 | - ^b | 7.6 |
| Low Income | 35.2 | 10.0 | 22.6 | 32.2 |
| Other | 24.0 | 35.2 | 36.8 | 4.1 |
| <u>South</u> | | | | |
| Total | 29.7 | 28.9 | 29.2 | 12.2 |
| White | 30.3 | 31.1 | 30.6 | 8.0 |
| Black | 27.8 | 16.9 | 22.9 | 32.4 |
| Hispanic | 27.5 | 34.0 | 27.2 | 11.3 |
| Other | 21.3 | 24.1 | 29.3 | 25.4 |
| Low Income | 36.9 | 10.8 | 17.5 | 34.9 |
| Other | 27.6 | 34.2 | 32.7 | 5.5 |
| <u>West^c</u> | | | | |
| Total | 36.3 | 32.4 | 21.6 | 9.7 |
| White | 35.0 | 35.7 | 21.8 | 7.5 |
| Black | 43.1 | 16.4 | 12.8 | 27.7 |
| Hispanic | 42.1 | 23.0 | 23.1 | 11.8 |
| Other | 31.9 | 22.7 | 29.4 | 16.1 |
| Low Income | 40.5 | 10.7 | 16.4 | 32.5 |
| Other | 35.4 | 37.2 | 22.7 | 4.7 |

^aThe 48 contiguous states.

^bNo households in RECS data for this category.

^cExcludes Alaska and Hawaii.

Source: Ref. 2.

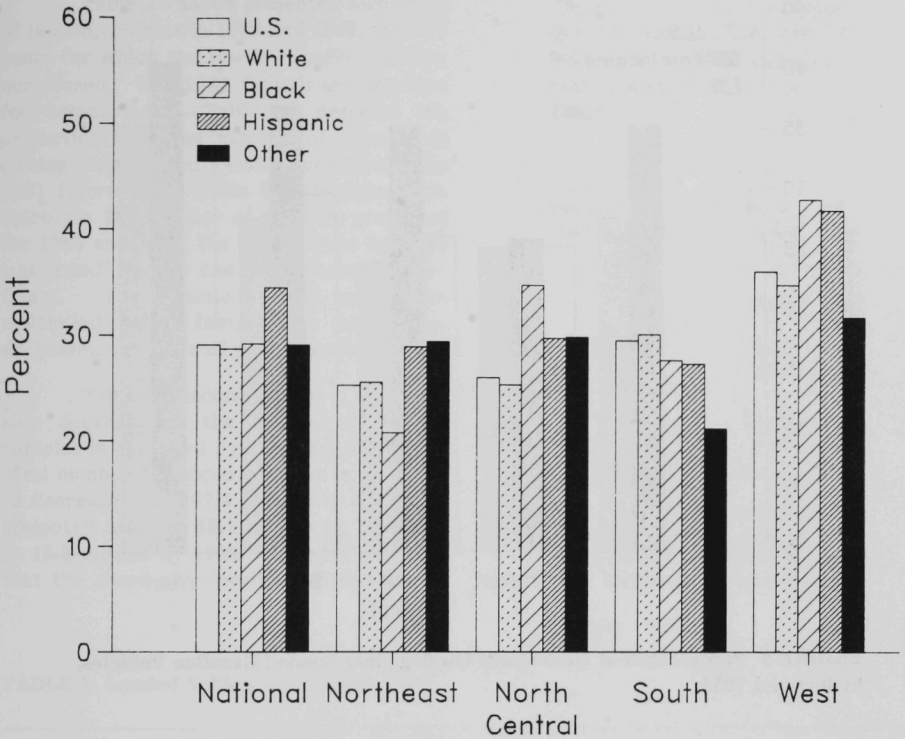


FIGURE 8 Percentages of Households Owning Only Leaded Gasoline Vehicles, by Race, 1981

metropolitan area and its excellent rapid transit network. About one-third of low-income households in the other regions are without cars.

The groups most likely to bear costs from the reduced use of lead in gasoline, yet those least capable of absorbing the cost, are low-income households in areas with no alternative transportation, e.g., outside large metropolitan areas with public transit. Minorities are disproportionately represented in low-income households when compared with all households or with white households.

Gasoline purchases as a percentage of household income are examined in Table 8 to indicate the relative burden due to increased household expenditures for gasoline caused by a reduction of lead in gasoline. Black households that own vehicles spent a larger percentage of their income on gasoline than do all households or white households. As expected, low-income households spent a significantly higher percentage of their income on gasoline than did any other population category. This indicates that

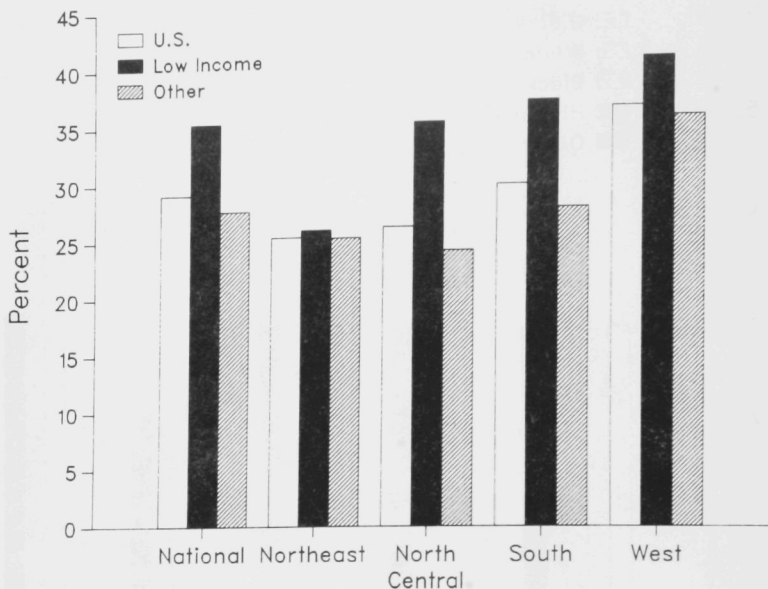


FIGURE 9 Percentages of Households Owning Only Leaded Gasoline Vehicles, by Income, 1981

an increase in expenditures for gasoline would fall more heavily on minority and low-income households than on the overall population. It does not, however, take into account a change in gasoline consumption by a given group due to a price increase; this would require an analysis of demand at various income levels, which is beyond the scope of this report.

4.3 VEHICLE POPULATION

In Table 9, ownership of leaded gasoline vehicles by household is shown by minority group, income level, and metropolitan location. In 1981, just over half of the nation's household vehicles used leaded gasoline. This number is decreasing rapidly as older vehicles are scrapped. Nearly 60% of these vehicles were in the South and West regions in 1981, where 52% of the nation's households were located. Nationally, 40% were in SMSAs outside the central cities, which account for about one-third of the nation's households. In the South and North Central regions, however, more leaded gasoline vehicles were located in non-SMSA areas than in either sector of their SMSAs. Nationally, only 35% of the leaded gasoline vehicles were found in non-SMSA areas, which contain 31.5% of all households.

Table 10 shows projected ownership of leaded vehicles in 1986 and 1988, the two years for which the low-lead option is being considered. The 1981 figures are provided for comparison. Table 11 presents the projections for the number of households owning only leaded gasoline vehicles. The 1981 figure from Table 6 is included. To calculate the number of vehicles projected for 1986 and 1988, the RECS2 data for 1981 was "aged" by five and seven years, respectively. The vehicle figures were then multiplied by a factor that allows for decreasing numbers of vehicles over time.

Table 10 indicates that a considerable decrease in the number of leaded vehicles is expected by 1986 and 1988. The total number of leaded vehicles is expected to decrease from 67.4 million in 1981 to a projected level of 28.1 million by 1986 and to 18.6 million by 1988. Table 11 indicates that the share of minority and low-income

TABLE 8 Gasoline Purchases as a Percentage of Household Income in the 48 Contiguous States, April 1980-March 1981^a

| Population Category | Percentage of Income |
|---------------------|----------------------|
| Total | 5.3 |
| White | 5.2 |
| Black | 6.9 |
| Low Income | 16.5 |
| Other | 5.0 |

^aVehicle-owning households only. Hispanic and other households are omitted due to small sample size.

Source: Ref. 1.

TABLE 9 Leaded Vehicle Ownership, 1981

| Population Category | National ^a | | Northeast | | North Central | | South | | West ^b | |
|---------------------|---|-------|---|-------|---|-------|---|-------|---|-------|
| | No. of Leaded Vehicles (10 ⁶) | % | No. of Leaded Vehicles (10 ⁶) | % | No. of Leaded Vehicles (10 ⁶) | % | No. of Leaded Vehicles (10 ⁶) | % | No. of Leaded Vehicles (10 ⁶) | % |
| Total | 67.38 | 100.0 | 11.97 | 100.0 | 16.21 | 100.0 | 22.69 | 100.0 | 16.51 | 100.0 |
| White | 57.63 | 85.5 | 10.47 | 87.5 | 15.04 | 92.8 | 18.95 | 83.5 | 13.17 | 79.8 |
| Black | 5.31 | 7.9 | 1.02 | 8.6 | 0.76 | 4.7 | 2.63 | 11.6 | 0.90 | 5.4 |
| Hispanic | 3.70 | 5.5 | 0.38 | 3.2 | 0.30 | 1.8 | 0.96 | 4.2 | 2.06 | 12.5 |
| Other | 0.74 | 1.1 | 0.10 | 0.8 | 0.11 | 0.7 | 0.15 | 0.7 | 0.38 | 2.3 |
| Low Income | 9.03 | 13.4 | 1.00 | 8.4 | 2.49 | 15.3 | 3.71 | 16.4 | 1.83 | 11.1 |
| Other | 58.35 | 86.6 | 10.97 | 91.6 | 13.72 | 84.7 | 18.98 | 83.6 | 14.68 | 88.9 |
| SMSA Central City | 16.62 | 24.7 | 2.51 | 21.0 | 3.74 | 23.1 | 5.53 | 24.4 | 4.84 | 29.3 |
| SMSA Other | 27.18 | 40.3 | 6.16 | 51.5 | 5.86 | 36.1 | 7.01 | 30.9 | 8.15 | 49.4 |
| Non-SMSA | 23.58 | 35.0 | 3.30 | 27.5 | 6.62 | 40.8 | 10.16 | 44.8 | 3.51 | 21.3 |

^aThe 48 contiguous states.

^bExcludes Alaska and Hawaii.

Source: Ref. 2.

TABLE 10 Households Owning Leaded Gasoline Vehicles in the 48 Contiguous States in 1981, and Projected Ownership for 1986 and 1988

| Population Category | 1981 | | 1986 | | 1988 | |
|---------------------|------------------------------------|-------|------------------------------------|-------|------------------------------------|-------|
| | No. of Vehicles (10 ⁶) | % | No. of Vehicles (10 ⁶) | % | No. of Vehicles (10 ⁶) | % |
| Total | 67.4 | 100.0 | 28.1 | 100.0 | 18.6 | 100.0 |
| White | 57.6 | 85.5 | 24.0 | 85.4 | 15.9 | 85.4 |
| Black | 5.3 | 7.9 | 2.2 | 7.9 | 1.4 | 7.7 |
| Hispanic | 3.7 | 5.5 | 1.5 | 5.4 | 1.0 | 5.5 |
| Other | 0.7 | 1.1 | 0.3 | 1.2 | 0.2 | 1.3 |
| Low Income | 9.0 | 13.4 | 3.4 | 11.9 | 2.1 | 11.5 |
| Other | 58.4 | 86.6 | 24.7 | 88.1 | 16.5 | 88.5 |

Source: Ref. 2.

TABLE 11 Households Owning Only Leaded Gasoline Vehicles in the 48 Contiguous States in 1981, and Projected Ownership for 1986 and 1988

| Population Category | 1981 | | 1986 | | 1988 | |
|---------------------|--------------------------------------|-------|--------------------------------------|-------|--------------------------------------|-------|
| | No. of Households (10 ⁶) | % | No. of Households (10 ⁶) | % | No. of Households (10 ⁶) | % |
| Total | 24.1 | 100.0 | 5.9 | 100.0 | 3.3 | 100.0 |
| White | 19.6 | 81.4 | 4.6 | 78.0 | 2.6 | 78.8 |
| Black | 2.6 | 10.8 | 0.7 | 11.9 | 0.4 | 12.1 |
| Hispanic | 1.6 | 6.5 | 0.5 | 8.5 | 0.3 | 9.1 |
| Other | 0.3 | 1.3 | 0.1 | 1.7 | -- ^a | -- |
| Low Income | 5.6 | 23.1 | 2.1 | 35.6 | 1.3 | 39.4 |
| Other | 18.5 | 76.9 | 3.9 | 66.1 | 2.0 | 60.6 |

^aLess than 50,000.

Source: Ref. 2.

households owning only leaded gasoline vehicles will increase over time as leaded gasoline vehicles decrease in number.

Thus, when the EPA proposal for the low-lead option would take effect in 1986, there would be 58.3% fewer leaded gasoline vehicles than in 1981. The costs to minorities and low-income households overall (as well as to all households) would be reduced considerably by the time the EPA action would take effect. However, the share of leaded gasoline vehicles owned by minority and low-income households will very likely increase over time, resulting in disproportional costs to these groups.

4.4 SUMMARY

Some costs would be likely to accrue to households owning leaded gasoline vehicles, particularly those that own only such vehicles. The costs would arise from two sources: (1) possible increases in the retail price of the gasoline selected by households after the phasedown (87-octane unleaded, higher octane unleaded, or the low-lead fuel if it is allowed) and (2) net increase in maintenance costs (possible early failure of the engine due to uneven wear, increased costs for spark plugs, etc.). These costs are very difficult to assess precisely because of volatile prices of gasoline generally and because of the small amount and conflicting nature of data on the behavior of engines using leaded gasoline. Some costs would be likely, however. Also, the real price of gasoline has been falling since 1981, further complicating a thorough analysis of price and cost impacts.

Minority groups on the whole would experience fewer costs associated with the phasedown because they own fewer vehicles. Conversely, minority and low-income households owning only leaded gasoline vehicles are disproportionately represented in the most-affected group, and it is expected that the share of these groups will increase over time. Households in areas without alternative transportation and that own only leaded gasoline vehicles also would be disproportionately affected by these costs. These households are generally less likely to be low-income or minority; however, low-income households in non-SMSA areas would be affected more than households with incomes above 125% of the poverty level because they own proportionately more vehicles that can use leaded gasoline.

The magnitude of these costs has not been identified, but it would be less than 10% of the average household's gasoline bill (Table 8). The steepest one-year increase in the real price of gasoline (25%) occurred in 1978-1979 (in 1978-1980, a 50% increase occurred). From 1981 to 1982, real weighted gasoline prices dropped 12%, then 9% from 1982 to 1983.⁹ The influence of the phaseout of leaded gasoline could be assumed to last one year and range from -10% to +10% of non-phaseout gasoline prices. The upper limit is lower than the highest end of the price range seen in this decade because the stimulus provoking the sharpest increase was international and very abrupt. The phasedown proposed by EPA constitutes a gradual process, announced in advance, and encompasses only the U.S.

5 HOUSEHOLD BENEFITS AND COSTS

This section describes how benefits and costs might accrue to households because of adoption of the low-lead option or a ban on leaded gasoline. Household benefits and costs were divided into high, medium, and low categories (Table 12). Because a reduction of lead in gasoline would benefit households exposed to a higher level of emissions more than households with lower exposure levels (see the discussion of assumptions in Sections 2 and 3), and because small children are at a greater risk of adverse health affects than are adults or older children, households receiving high benefits were defined as those with small children in SMSA central cities. By the same reasoning, medium benefits would accrue to SMSA central city households with no children or older children only, and also to all non-SMSA households with small children. Low benefits would accrue to non-SMSA households with no children or older children only.

Costs are divided into the same three categories, but are based solely on the type of household vehicle(s). Households with high costs were defined as those with only leaded gasoline vehicles. Medium costs were defined as accruing to households with vehicles that use leaded gasoline and vehicles that require unleaded gasoline. Households with low costs were defined as those either with vehicles using unleaded gasoline, or with no vehicles. The basis for this reasoning is found in Section 4.

In Table 12, the sum of all nine cells in the three rows for a particular category equals the total number of households in that category. Summing percentages across a row for a category and then summing the row totals will equal 100%. The four corner cells are of most concern here.

The highest percentages of minorities in the four corner cells are in the high-benefit/low-cost cell. This accounts for more than 1.5 million minority households. All three of the minority categories have a larger share of their households in this cell than the total share for all U.S. households. More than 22% of the black and other households, and almost 9% of Hispanic households, are in this cell, while 3.2% of all households are also in this cell.

The other cell in which minorities tend to have higher shares of their households is that for high benefits and high costs. However, this cell contains less than half as many minority households as does the high-benefit/low-cost cell.

Lower percentages of minority households are in both the low-benefit/low-cost cell and the low-benefit/high-cost cell than the total percentages for all households. This is partially explained by data indicating that minority households (1) tend to be more urban than white households and (2) have low rates of vehicle ownership.

For low-income households (with incomes below 125% of the poverty level), the picture is somewhat different. Many of these households -- more than 25% -- are in the low-benefit/low-cost cell or the low-benefit/high-cost cell. These households, in turn, make up non-SMSA low-income households that have (1) no vehicles and no small children (15%) and (2) no small children and vehicles using leaded gasoline (10.7%).

TABLE 12 National Households, by Minority and Income Category, to Which Benefits and Costs Accrue Because of Reduced Lead in Gasoline, 1981

| Population Category | Low Benefit ^a | | Medium Benefit ^b | | High Benefit ^c | |
|---|--------------------------------------|---------------|--------------------------------------|---------------|--------------------------------------|---------------|
| | No. of Households (10 ⁶) | % of Category | No. of Households (10 ⁶) | % of Category | No. of Households (10 ⁶) | % of Category |
| Low Cost (Households with no vehicles or unleaded vehicles only) | | | | | | |
| Total | 7.68 | 9.3 | 24.53 | 29.7 | 2.66 | 3.2 |
| White | 6.58 | 9.7 | 19.85 | 29.1 | 1.14 | 1.7 |
| Black | 0.82 | 9.2 | 3.01 | 33.9 | 1.00 | 11.3 |
| Hispanic | 0.24 | 5.2 | 1.28 | 28.4 | 0.40 | 8.9 |
| Other | 0.05 | 4.3 | 0.40 | 36.2 | 1.24 | 11.1 |
| Low Income | 2.36 | 15.0 | 5.07 | 32.2 | 1.24 | 7.9 |
| Other | 5.33 | 8.0 | 19.47 | 29.1 | 1.42 | 2.1 |
| Medium Cost (Households with both leaded and unleaded vehicles) | | | | | | |
| Total | 6.18 | 7.5 | 16.38 | 19.8 | 1.21 | 1.5 |
| White | 5.76 | 8.4 | 14.49 | 21.2 | 0.81 | 1.2 |
| Black | 0.27 | 3.1 | 0.95 | 10.6 | 0.24 | 2.7 |
| Hispanic | 0.12 | 2.7 | 0.77 | 17.1 | 0.14 | 3.1 |
| Other | 0.02 | 2.2 | 0.17 | 15.5 | 0.02 | 1.6 |
| Low Income | 0.61 | 3.9 | 0.80 | 5.1 | 0.11 | 0.7 |
| Other | 5.56 | 8.3 | 15.58 | 23.3 | 1.10 | 1.6 |
| High Cost (Households with leaded vehicles only) | | | | | | |
| Total | 6.47 | 7.8 | 15.94 | 19.3 | 1.66 | 2.0 |
| White | 5.83 | 8.6 | 12.78 | 18.7 | 0.98 | 1.4 |
| Black | 0.43 | 4.8 | 1.85 | 20.8 | 0.32 | 3.6 |
| Hispanic | 0.19 | 4.2 | 1.06 | 23.4 | 0.31 | 6.9 |
| Other | 0.02 | 1.4 | 0.26 | 23.9 | 0.04 | 3.8 |
| Low Income | 1.69 | 10.7 | 3.31 | 21.0 | 0.56 | 3.6 |
| Other | 4.78 | 7.1 | 12.63 | 18.9 | 1.10 | 1.6 |

^aNon-SMSA households with no children or older children only.

^bNon-SMSA households with small children, plus all households in SMSAs other than in central cities, and SMSA central city households with no children or older children only.

^cSMSA central city households with small children.

Source: Ref. 2.

Table 13 shows percentages of households to which benefits and costs accrue. These are the sums of the percentages across the rows and down the columns from Table 12. The values indicate distinct differences between minority households and low-income households in terms of benefits; this appears in the low-benefit/cost category. In this category, the share for black, Hispanic, and other households is lower than that for all households, while the share of low-income households is higher. This reflects the large number of white low-income households with no children in non-SMSA areas.

For the remaining three benefit and cost percentage totals in Table 13, the share of minority households and low-income households is greater than that for all households.

In summary, a reduction of lead in gasoline would benefit minority and low-income households proportionately more than the overall U.S. population, based on the values in the high-benefit category of Table 13. This is due to the relatively large share of minority and low-income households living in SMSA central cities, as well as to the relatively large share of these households with small children. However, an even larger share of low-income households are in the low-benefit category. This is explained by the relatively high number of white low-income households living in non-SMSA areas.

From the values in the costs column of Table 13, it can be seen that minority and low-income households would have proportionately lower costs imposed on them because a greater-than-average share of these households are in the low-cost category. Moreover, a greater share of both minority and low-income households are in this category than in the high-cost category. This reflects the relatively high rate of minority and low-income households that own no vehicles.

TABLE 13 U.S. Households^a in the Low, Medium, and High Categories of Benefits and Costs, 1981

| Population Category | Percentage of Households Incurring | |
|------------------------|--|-------|
| | Benefits | Costs |
| Low Benefit/Cost | | |
| Total | 24.6 | 42.2 |
| White | 26.6 | 40.4 |
| Black | 17.1 | 54.3 |
| Hispanic | 12.2 | 42.6 |
| Other | 7.9 | 51.6 |
| Low Income | 29.6 | 55.1 |
| Other | 23.4 | 39.1 |
| Medium Benefit/Cost | | |
| Total | 68.8 | 28.8 |
| White | 69.1 | 30.9 |
| Black | 65.3 | 16.4 |
| Hispanic | 68.9 | 22.9 |
| Other | 75.6 | 19.3 |
| Low Income | 58.3 | 9.6 |
| Other | 71.2 | 33.2 |
| High Benefit/Cost | | |
| Total | 6.7 | 29.1 |
| White | 4.3 | 28.7 |
| Black | 17.6 | 29.2 |
| Hispanic | 18.9 | 34.5 |
| Other | 16.5 | 29.1 |
| Low Income | 12.1 | 35.3 |
| Other | 5.4 | 27.6 |

^aThe 48 contiguous states.

Source: Ref. 2.

APPENDIX A

Table A.1 (Cont.) The number of species per site for the 47 species in the 100 sites. The number of sites in which a species was found is given in parentheses.

Table A.2 (Cont.) The number of species per site for the 47 species in the 100 sites. The number of sites in which a species was found is given in parentheses. The number of sites in which a species was found is given in parentheses. The number of sites in which a species was found is given in parentheses.

TABLE A.2 (Cont.) Species per site - 100 sites

For the 100 sites, the number of species per site is given in parentheses.

APPENDIXES

Table A.3 (Cont.) The number of species per site for the 47 species in the 100 sites. The number of sites in which a species was found is given in parentheses.

Table A.4 (Cont.) The number of species per site for the 47 species in the 100 sites. The number of sites in which a species was found is given in parentheses.

Table A.5 (Cont.) The number of species per site for the 47 species in the 100 sites. The number of sites in which a species was found is given in parentheses.

Table A.6 (Cont.) The number of species per site for the 47 species in the 100 sites. The number of sites in which a species was found is given in parentheses.

Table A.7 (Cont.) The number of species per site for the 47 species in the 100 sites. The number of sites in which a species was found is given in parentheses.

APPENDIX A: SAMPLE SIZE FOR RECS2

Table A.1 shows the number of households in the RECS2² sample by region, race, and income status. Values are also presented for households in SMSA (Standard Metropolitan Statistical Area) central cities, the focus of much of this report's analysis.

Although RECS2 covers all 50 states, the public-use tapes available for that survey exclude data for Alaska and Hawaii to preserve confidentiality. As a result, data are for the 48 contiguous states only. Because the total number of households in the two states is small (425,000, or 0.5%, in 1980), this is not a major omission. Further, only three minority population groups are found in significant numbers in these two states -- Asians in Hawaii and Eskimos and Aleuts in Alaska. This study does not specifically address either of these groups, focusing instead on blacks and Hispanics.

TABLE A.1 Households Sample Counts in RECS2, 1981

| Population Category | National ^a | Northeast | North Central | South | West ^b |
|--------------------------|-----------------------|-----------|---------------|-------|-------------------|
| All Locations | | | | | |
| Total | 6204 | 1258 | 1407 | 2108 | 1431 |
| White | 4981 | 993 | 1274 | 1570 | 1144 |
| Black | 775 | 173 | 95 | 425 | 82 |
| Hispanic | 364 | 75 | 31 | 101 | 157 |
| Other | 84 | 17 | 7 | 12 | 48 |
| Low Income | 1358 | 217 | 277 | 595 | 269 |
| SMSA Central Cities Only | | | | | |
| Total | 1744 | 409 | 341 | 594 | 400 |
| White | 1120 | 218 | 251 | 365 | 286 |
| Black | 425 | 130 | 76 | 173 | 46 |
| Hispanic | 157 | 48 | 10 | 53 | 45 |
| Other | 42 | 13 | 4 | 3 | 22 |
| Low Income | 474 | 113 | 94 | 170 | 97 |

^aThe 48 contiguous states.

^bExcludes Alaska and Hawaii.

Although the RECS2 survey includes more than 6000 households, it is not broad enough to provide 20 or more households for each minority group in every tabulation of interest. Several entries in tables have no representation in RECS2 or are based on very small samples. Also, errors have been discovered in a few instances in RECS2: for example, black households with children in the SMSA central cities of the Northeast region were overrepresented in the sample by 15.5%.

APPENDIX B: POVERTY-LEVEL HOUSEHOLDS

The criteria for low-income households are taken from RECS, which in turn relied on category definitions established by the Bureau of the Census. In this report, low-income households are those with incomes of less than 125% of the poverty level; records for these households were flagged on the public-use tapes. Income criteria for the RECS2 survey in 1982 (reporting 1981 income) are shown in Table B.1. For this definition, household size is determined by the number of related persons in the household, rather than by all persons in the household. These criteria yield a national total of 15.75 million households with incomes of less than 125% of the poverty level (based on 1358 observations).

TABLE B.1 Criteria for 125% Poverty Level, 1981

| No. of Related Persons in Household | Household Income (1980 \$) |
|---|-------------------------------|
| 1 | <5,000 |
| 2 | <7,000 |
| 3 | <8,000 |
| 4 | <10,000 |
| 5 | <12,000 |
| 6 | <14,000 |
| 7 or more | <17,000 |

Source: Ref. 10.

APPENDIX C: CLASSIFICATION OF HOUSEHOLD VEHICLES AS LEADED FUEL USERS

The primary source of data for this analysis of groups likely to be affected by a phaseout of leaded gasoline (or a switch to 0.1 grams of lead per gallon of leaded gasoline) is the Residential Energy Consumption Survey taken by the Energy Information Administration in 1981-1982 and known as RECS2.² This survey of 6204 households is the latest in a series of surveys of household energy use conducted since 1978. (RECS3, based on a survey taken in 1982-1983, will be released soon.)

For this analysis it was necessary to identify vehicles by household and type of gasoline used. The RECS2 survey provided vehicle model year, make, type, and model name. The first three characteristics were used to identify vehicles using leaded gasoline. No effort was made to identify diesel-fueled vehicles because that information is available only by model name or in the accompanying files on fuel purchase logs (the Transportation Panel tape), neither of which was used for this analysis. The time required to use either of those would not be rewarded by a substantial increase in accuracy due to the very low frequency of household diesel vehicles.

The classification of vehicles using leaded gasoline is as follows, by model year:

- Through 1974: All use leaded fuel.
- 1975 through 1980: Some use leaded fuel:
 - Japanese imports.
 - Some domestic light trucks.
 - Some domestic automobiles.
- 1981 on: None use leaded fuel.

All household vehicles (except "Other Trucks," which were excluded from this analysis) from the 1974 model year or earlier are classified as using leaded gasoline. All vehicles of 1981 or later model years are classified as using unleaded gasoline. For vehicles with a model year from 1975 through 1980, the following were identified as leaded gasoline users:

- Nissan, Mitsubishi, Datsun, Honda, Isuzu, Subaru, and Toyota.
- Pickup trucks other than GM: Dodge, Ford, International, Jeep, American Motors, Volkswagen, Chrysler, Plymouth, and Japanese makes listed above.
- American Motors in model years 1975, 1976, and 1977 only.
- Chrysler in model years 1975 and 1976 only.
- Ford in model year 1975 only.

All other vehicles manufactured in this period are assumed to use unleaded gasoline. Because this analysis focuses on identifying households that are legitimate users of leaded gasoline, precise identification of other fuel types is not essential, and errors should be in the direction of underestimating leaded gasoline users. Results of RECS1 and RECS2 tabulations indicate that vehicles using leaded gasoline are distributed as shown in Table C.1.

We also identified pre-1972 vehicles (Table C.2) because their susceptibility to engine wear from unleaded gasoline is greater than that of 1972 and later vehicles. In 1981, only 39% of the leaded gasoline vehicles were manufactured before 1972. As might be expected, the number of pre-1972 vehicles decreased between the two surveys. The low scrappage rate of the vehicles indicated in Table C.2 includes some sampling error. According to Table C.1, 3.3 million leaded gasoline vehicles were scrapped, but apparently only 372,000 were pre-1972.

The classification of vehicles shown in Table C.2 was *not* used in this analysis. The data are included only to provide further insight into the age distribution of leaded gasoline vehicles.

TABLE C.1 Household Vehicles Using Leaded Fuel^a (10⁶ vehicles)

| Vehicle Model Year | RECS1 - 1980 | | | RECS2 - 1981 | | |
|-----------------------|--------------|------------------------------|--------------------|--------------|------------------------------|--------------------|
| | Autos | Light Trucks ^b | Total ^c | Autos | Light Trucks ^b | Total ^c |
| 1974 or earlier | 43.53 | 12.29 | 56.31 | 40.31 | 11.81 | 52.57 |
| 1975-1980 | 8.49 | 5.83 | 14.32 | 8.88 | 5.85 | 14.82 |
| 1981 and later | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 52.02 | 18.12 | 70.63 | 49.18 | 17.66 | 67.38 |

^aThis report uses RECS2 data for vehicle estimates.

^bIncludes jeeps, passenger and cargo vans, and pickup trucks.

^cTotal includes Other, not shown separately.

TABLE C.2 Model Year 1971 and Earlier Household Vehicles^a (10⁶ Vehicles)

| RECS1 - 1980 | | | RECS2 - 1981 | | |
|--------------|---------------------------|--------------------|--------------|---------------------------|--------------------|
| Autos | Light Trucks ^b | Total ^c | Autos | Light Trucks ^b | Total ^c |
| 19.74 | 6.86 | 26.82 | 19.56 | 6.70 | 26.45 |

^aThis report uses RECS2 data for vehicle estimates.

^bIncludes jeeps, passenger and cargo vans, and pickup trucks.

^cTotal includes Other, not shown separately.

REFERENCES

1. *Residential Energy Consumption Survey (RECS): 1980-1981: Transportation Panel, Monthly Gasoline Purchases and Vehicle and Household Characteristics, June 1979-September 1981*, Energy Information Administration, U.S. Dept. of Energy (public-use tape).
2. *Residential Energy Consumption Survey (RECS) 1981-1982, Household Monthly Energy Consumption and Expenditures*, Energy Information Administration, U.S. Dept. of Energy (public-use tape).
3. *Costs and Benefits of Reducing Lead in Gasoline*, U.S. Environmental Protection Agency, Office of Policy Analysis (March 1984).
4. Regulation of Fuels and Fuel Additives; Lead Phase Down 49 Fed. Reg. 31032 (1984) (to be codified at 40 C.F.R. pt. 80) (proposed August 2, 1984).
5. Regulation of Fuels and Fuel Additives; Gasoline Lead Content 50 Fed. Reg. 9386 (1985) (to be codified at 40 C.F.R. pt. 80) (March 7, 1985).
6. Addendum I, Comments on the NHANES II Data, Ethyl Corp. (Feb. 1984).
7. Comments Regarding EPA's Public Hearing on Regulation of Fuel and Fuel Additives, Ethyl Corp. (April 1982).
8. American Automobile Association, Chicago office, personal communication (April 1984).
9. *Monthly Energy Review*, Energy Information Administration, U.S. Dept. of Energy (1984).
10. Statement Presented to the Clean Air Scientific Advisory Committee, Research Triangle Park, N.C. (April 1984).

MEMORANDUM

TO : THE PRESIDENT

FROM : THE SECRETARY OF STATE

SUBJECT: [Illegible]

DATE: [Illegible]

1. [Illegible]

2. [Illegible]

3. [Illegible]

4. [Illegible]

5. [Illegible]

6. [Illegible]

7. [Illegible]

8. [Illegible]

9. [Illegible]

10. [Illegible]

11. [Illegible]

12. [Illegible]

13. [Illegible]

14. [Illegible]

15. [Illegible]

16. [Illegible]

17. [Illegible]

18. [Illegible]

19. [Illegible]

20. [Illegible]

21. [Illegible]

22. [Illegible]

23. [Illegible]

24. [Illegible]

25. [Illegible]

26. [Illegible]

27. [Illegible]

28. [Illegible]

29. [Illegible]

30. [Illegible]

31. [Illegible]

32. [Illegible]

33. [Illegible]

34. [Illegible]

35. [Illegible]

36. [Illegible]

37. [Illegible]

38. [Illegible]

39. [Illegible]

40. [Illegible]

41. [Illegible]

42. [Illegible]

43. [Illegible]

44. [Illegible]

45. [Illegible]

46. [Illegible]

47. [Illegible]

48. [Illegible]

49. [Illegible]

50. [Illegible]

51. [Illegible]

52. [Illegible]

53. [Illegible]

54. [Illegible]

55. [Illegible]

56. [Illegible]

57. [Illegible]

58. [Illegible]

59. [Illegible]

60. [Illegible]

61. [Illegible]

62. [Illegible]



3 4444 00032182 8

X

